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Columbia-Yale Project: Use of Software to Achieve Competitive Advantage

Gaining and Sustaining Long-term Advantage Through Information Technology

The Emergence of Controlled Production

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SOFTWARE AS A TOOL OF COMPETITIVE ADVANTAGE:

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Introduction: Objective and Status of this Study

This paper summarizes the results of several case studies comparing how U.S. and Japanese firms successfully use software and information technology to achieve long-term sustainable and competitive advantages in various industries. Each case is complete within itself, but also part of a larger study researching pairs of U.S. and Japanese firms using information technology as an integral part of their business strategies. The industries and firms examined include investment and retail banking, life insurance, food and apparel retailing (the distribution side of these two industries), semiconductors, pharmaceuticals, automobile production, and mini-mill and integrated steel making

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The case studies completed to date⁻ advances our hypothesis that while Japan is competitively far behind in producing most software, especially packaged software, some Japanese firms in major industries are very sophisticated software users. These firms have integrated software into their management strategies and use it to institutionalize organizational strengths and capture tacit knowledge on an iterative basis. In the past, this strategy has relied heavily on customized and semi-customized software (Rapp 1995), but now it appears to be changing toward a more selective use of package software that is managed through customized systems, including customized middleware. Interestingly, their U.S. counterparts, who have generally relied more on packaged software, are doing more customization, especially of systems needed to integrate various software packages into something more closely linked with their business strategies, markets, and organizational structure. Thus, there appears to be some convergence among these leading U.S. and Japanese software users, though they are utilizing different approaches.

These case studies confirm what some analysts have argued in the past. Namely, that a coherent business strategy is a necessary condition for a successful information technology strategy (Wold and Shriver, 1993). Our results also counter one major tenet of re-engineering which argues that the successful use of information technology requires a substantial corporate reorganization to achieve significant improvements in productivity.

Contrary to the expectations of these analysts, the case studies we have researched suggest that successful business and information strategies have not led to, or emerged from, a change in corporate culture. Rather, firms have used these strategies to codify and institutionalize their existing cultures, core competencies and organizational structures. Furthermore, these strategies and cultures have been designed to use technology to improve product or service development and delivery.

In sum, leading Japanese and U.S. firms are moving positively toward a similar strategic and operational balance point with respect to using software to improve competitiveness. They reject re-engineering or any major corporate reorganization as part of their strategies, but have elected to maintain control over software purchasing and development. Furthermore, they have avoided outsourcing except for certain low-technology, low-priority tasks, such as payroll, because of the perceived benefits of controlling the integration and use of software and information technology in their business and organization. In addition, Japanese and U.S. firms indicate that industry-

⁻ This refers to firms for which interviews are complete. So excludes AMD, H. E. Butts, Nucor, WalMart, USAA.

specific vertical application software is increasing in importance within the global software industry as they develop and integrate information systems specific to their industry and competitive situation. Thus, they confirm our second research hypothesis that some firms consciously and successfully use software to pursue competitive advantage.

The design and implementation of each company's software and software strategy is unique to each firm and its competitive situation, industry and strategic objectives. These factors influence how they choose between packaged and customized software options for achieving specific goals and how they measure their success. For example, NEC views their semiconductor business as global and highly price competitive, especially in generic commodity products such as DRAMs. For this reason they require total flexibility in introducing the latest production or design software packages. Since the software programs are generally in English and their production is global, all of their software and supporting systems, costing two to three times less than localizing software, offers them the most flexibility in introducing improvements and controlling costs. Alternatively, Meiji Life relies on a localized and then customized version of windows NT. Since their competition is entirely within Japan, the success of their new software delivery system, a network of laptops carried by 40,000 representatives, depends upon the representative and the customer understanding the information presented with ease. Therefore, the software must be in Japanese. In addition, these laptops must be able to receive and send information to Meiji's network servers and mainframes that use heavily customized systems, also in Japanese.

As part of their strategic integration, the leading software users we interviewed have linked their software strategies with their overall management goals through mission statements that clearly express the importance of information technology to firm success. In turn, they have coupled this with the active participation of the CIO and their information technology support group into the firm's business and decision making structure. Thus, for these firms, the independent MIS department appears a thing of the past. This may be another reason why outsourcing is generally not a viable option among them. However, it is also evident that the successful performance of these firms is not solely contingent upon their software.

Although software is an integral element in their overall management strategy and plays a key role in serving corporate goals, such as enhancing productivity, improving inventory management or strengthening customer relations, these systems must be coupled with an appropriate approach to R&D, manufacturing and marketing (as in the case of NEC in semiconductors or Merck in pharmaceuticals). All of the firms we interviewed clearly understood this necessity. In fact, one aspect common among all of the firms was a clear understanding of their business, industry and competitive strengths. Establishing a clear business vision enabled the firms to select, develop and use an appropriate type of software for each business function as well as integrate them into a total support system for their operations to achieve positive corporate goals. (See Appendix for related questions.)

While the combination and emphasis on specific software and information technologies are unique to each firm, country and industry, the case studies also indicate that the firms have commonalities. Some are similar across a range of industries in both countries, others across a range in one country, and some within an industry in both countries. One theme common to all the cases is the creation of large proprietary

interactive databases that promote the automatic feedback between various stages and/or players in the production, delivery and consumption process. For example, Ito-Yokado uses a sophisticated real time interactive database to predict luncheon purchases at its various stores and restaurants by time of day and day of the week, helping to reduce inventory costs and wastage while improving customer service. A second theme is the reduction of inventories and the improved control of the production process. For example, a service company like Meiji Life expects to lower paper and storage costs substantially by reducing the number and size of its branches as well as the number of copies of each document it must retain for its records. This is a direct result of its new system.

We also found that organizationally and competitively successful software users are able to build beneficial feedback cycles or loops that increase productivity in areas as different as R&D, design and manufacturing while reducing cycle times and defects or integrating production and delivery. For example, integrating marketing, design and production has enabled NEC to forecast demand more accurately by designing products which better meet market requirements. This enables manufacturing to schedule production more efficiently, reducing in-plant inventories and cycle times while improving on-time delivery. Improved cycle times reduce costs but also increase the reliability of their forecasts since they need to cover a shorter period. Customer satisfaction is also improved through on-time delivery. Therefore, software inputs can be a critical factor in a firm's overall business strategy, leading to positive implications for competitiveness for those who implement them successfully and potentially negative implications for their competitors.

One important factor in this respect is the emergence of a new strategic manufacturing paradigm, which we have coined *Acontrolled@* production. Firms that utilize a strategy of *Acontrolled@* production (monitoring, controlling and linking every aspect of manufacturing from production to delivery) improve productivity significantly. This strategy is only possible if firms actively use information technology and software systems to continuously provide the necessary monitoring and control to what had previously been an automatic system response to changes in expected or actual consumer demand. These firms have proactively used information technology and that has provided them with a clear competitive advantage.

Our paradigm is based on the fact that all of these firms are successful competitors relative to their peers in terms of standard industry measures, such as market share, growth and profitability per employee, or assets employed. Furthermore, the skillful use of information technology is seen as an important step toward success by both the firms and analysts. However, judging by the case studies completed to date, software is most effective for a firm when it has been integrated with the business from both an operational and organizational standpoint and reflects the firm's overall business strategy and competitive vision. In addition, the software and systems development personnel need to be made part of the decision making structure while the system itself is an integral part of delivering and supporting the product and/or service. This difference is most clearly seen in the cases of Merck and NEC.

One interesting change in the normal lean production cycle is the break in the production line for many controlled producers. These manufacturers found that certain points in the assembly process had limited potential for productivity improvement. In

turn, this limited the potential for substantial improvements in a continuous manufacturing system. However, by breaking the line and having small buffer stocks, some parts of the line could be improved, freeing labor for other plant operations while the next subassembly line continued to operate. Controlling and monitoring these buffer stocks at various points in the manufacturing and delivery process is done through the use of software and information technology.

Seagate Technology may be correct when they state in their 1997 Annual Report, **AWe are experiencing a new industrial revolution, one more powerful than any before it. In this emerging digital world of the Third Millennium, the new currency will be information. How we harness it will mean the difference between success and failure, between having competitive advantage and being an also-ran.**@ This view was also supported in a recent presentation by Mr. Okuda, president of Toyota, entitled **AWhen the Ground Rules Change**@. He states: **AI now have discussed three watersheds in the history of the automobile industry. Each time, a new business model changed the ground rules for the industry. Each time the new model seemed invincible. And each time, it gave way to changing circumstances and a new business model. . . . Our old business model is breaking down for four main reasons. One, we need to decentralize our manufacturing and R&D activities . . . Two, the product and process paradigms that Henry Ford established are themselves breaking down . . . Three, information technology is transforming the inner workings of the automobile. It is also transforming the way we develop and make and sell our products. And four, the changing product paradigm and the growing role of information technology will open our industry to a vast array of competitors.**@

All of the firms we interviewed have decided to develop customized software to link packaged software together and adapt it to their existing organizational structure. In most cases, they have not tried to adapt the organizational structure to the software. Even though Meiji Life uses a standard localized Windows NT package to link their unique organizational software together, they, as well as others, have developed a customized software system within the information chain designed to set them apart from their competitors. Therefore, firms rely on customized software to give them a competitive edge. Given this perspective, both functional and market gains are considered to justify the additional expense incurred by customization, including the related costs of integrating the customized and packaged software into a single information system.

At the same time, it is apparent that even Japanese firms are relying more on packaged or semi-customized software to reduce costs compared to three years ago (Rapp 1995). The most aggressive firm in this regard is NEC due to intense global competitive pressures in semiconductors. Yet they are also using customized software to pull their operations together. Given this mixed software strategy, Japanese firms question the benefits of the general and extensive outsourcing of software technologies currently pursued by many U.S. firms. They believe that firms which focus heavily on outsourcing are overemphasizing the cost of software rather than analyzing its potential use in enhancing the firm's organization, operations and core competencies. Although Japanese firms use the systems employed by their competitors if there is no business advantage to developing their own, they reject the view that information systems are generic products best developed by outside vendors who can achieve low cost through

economies of scale and who can afford to invest in the latest technologies with some ease. Instead, these leading software users select their packaged software themselves, do their own packaging and systems integration, and add value at critical strategic junctions for their specific business through some customization and semi-customization. This means they reject the notion that it is feasible to buy a package if it delivers 80% of the functionality needed by the firm=s users since that extra 20% may be what achieves a strategic advantage.

This result was not surprising with respect to Japanese firms since an earlier study concluded that Japanese firms generally view software as integral to the production and delivery of a good or service (Rapp 1995). In turn, cost has been balanced against overall long-term productivity gains. However, we were somewhat surprised to see how adamant the leading U.S. software users were in this regard. If developing and using customized software results in competitive benefits, U.S. firms accept the increased cost. They also look favorably upon improved integration and enhanced control (from both an intellectual property and management perspective) gained from customization, but they are reluctant to yield control or responsibility of this strategy to a third party who may be driven by different objectives such as cost and more generalized technical improvements.

Merck and Citibank, in particular, believe customized software accounts for its success in the marketplace. Consistency, reliability and repetition are important elements in their strategic thinking. They believe extensive outsourcing would counter these strategic options since they feel systems service companies have an incentive to develop increasingly standardized products to improve their operational efficiencies. Outsourcing also places the firm further away from the market, which means they would lose many of the beneficial loops discussed above. In addition, they question the outside firm=s knowledge of their industry and its ability to design and integrate a software system into the user=s basic business. Given their clarity of vision, this seems a legitimate concern.

Methodology

This research project utilizes the case study method, developing cross-national pairs for key industries in the manufacturing and service sectors. In principle, each pair of case studies focus on one Japanese and one American firm in an industry in which software is a significant and successful input into competitive performance. To develop the studies, we have combined analyses from previous research results with questionnaires and direct interviews. We have also held working meetings with each center and combined new questionnaires with the materials we used in the previous study to either update or obtain a questionnaire similar to the one used in our 1993-95 research (Rapp 1995). This method has enabled us to relate each candidate and industry to earlier results.

We have also worked with the industry centers to develop questions that relate to a firm=s business strategy and the role of software within that. Some questions address issues that appear generally across industries such as inventory control. Others, such as managing the drug pipeline or pricing derivatives, are more specific to a particular industry. The focus has been to establish the firm=s perception of its industry and its competitive position as well as its advantage in developing and using a specific software strategy and approach. The team has also contacted customers, competitors, and industry analysts to determine whether competitive benefits or impacts perceived by the firm are

recognized outside of the organization. These sources have provided additional data on measures of competitiveness and on industry strategies and structure.

The case studies are therefore based on extensive interviews by the project team, augmenting existing data on industry dynamics, firm organizational structure and management strategy collected from the Sloan industry centers. In addition, we gathered data from outside sources, including firms and organizations with which we worked with on the earlier project.

Ideally, the project team has tried to select firms of similar size and product line, but this has not been possible in all cases. However, all of the firms chosen are large and significant competitors in their respective markets and use software, both innovative and packaged, synergistically with their business and organizational strategies to achieve significant competitive advantages in their industry. Furthermore, we believe the ways in which these firms use information technology and integrate it with their organizational and business structures to efficiently manage increasingly complex businesses, including learning from mistakes, should help other managers improve the consistency of their performance in terms of increased productivity, greater profitability, and better quality.

In developing the case studies, the project team sought to answer a specific set of questions while keeping in mind firm, country and industry differences. These questions appear in the Appendix and are based on our interviews and other research. The Appendix serves as a guide for readers who wish to assess the ways in which a firm's strategies toward using information technology address these issues. The questions are broken into the following general categories: General Management and Corporate Strategy, Industry Related Issues, Competition, Country Related Issues, IT Strategy, IT Operations, Human Resources and Organization, Various Metrics such as Inventory Control, Cycle Times and Cost Reduction, and finally some Conclusions and Results. They cover a wide range of issues, including the direct use of software to achieve competitive advantage, corporate strategy, criteria for selecting software, industry economics, measures of success, organizational integration, beneficial loops, training and institutional dynamics, and finally to interindustry comparisons.

We wish to thank the many Sloan industry research project teams who have cooperated with this study. These include the computer and software center at Stanford, the semiconductor and software centers at Berkeley, the financial services center at Wharton (University of Pennsylvania), the pharmaceutical and auto centers at MIT, the steel project at Carnegie-Mellon and the food services project at the University of Minnesota. We also thank the Sloan Foundation for providing the funding for this research project through a three-year grant.

Using Software to Improve Competitiveness in an Industry Context

As noted above, a number of Japanese firms in major industries are sophisticated software users who have integrated software into their management strategy and use it to institutionalize organizational strengths and capture tacit knowledge on an iterative basis. Historically, this strategy has involved a heavy reliance on customized and semi-customized software. Conversely, their U.S. counterparts have generally relied more on packaged software with an increasing number of U.S. firms outsourcing software design and development. Furthermore, industry-specific vertical application software and

embedded software are increasing in importance within the global software industry and, in some cases, are being strategically integrated too. Therefore, a firm may embed software into its production and delivery processes as well as its products.

Other strategies involve creating large interactive databases to allow automatic feedback between stages or players in the production and delivery process. They may also combine software with high-speed telecommunications technology. Yet, precisely how firms decide, design and implement these software strategies, how they measure success, and how they choose between packaged and customized software options for achieving specific goals, varies by firm, its particular competitive situation and the business strategies they have developed to achieve competitive success. There are related differences in how they actually link their software strategies with overall management goals, though it is clear that high performance firms do not succeed solely on the basis of software. Instead, software is an integral element of an overall management strategy, adapted to a particular industry and competitive situation. Nevertheless, not all strategies involve the retention of proprietary data. Some, for example, have established data banks on the Internet to which they contribute their own data and then encourage others to add. What is common to these approaches is that software is used to enhance and improve the way a firm implements its strategy and achieves its goals, as shown in the examples mentioned above and illustrated later in this paper.

At the same time, it became apparent through interviews with software users and developers that while software offers unique opportunities and benefits in terms of enhancing core competencies to achieve strategic objectives, it also poses risks. A firm can successfully introduce innovation using software and gain first mover advantages. Using software effectively may enable a firm to build beneficial feedback cycles that increase productivity, reduce cycle times and defects, and integrate production and delivery. Software may also be a way to capture externalities. However, when used ineffectively, such as insufficient attention to training or systems and organization integration, software can confound seemingly routine operations. To shed additional light on the role and impact of software as a tool of competitive advantage, several strategies are outlined below for particular firms in specific industries.

A key core competency for Merck is its ability to efficiently manage clinical trials and the FDA approval process. However, they have been limited in the number of drugs they can handle due to the number their top managers can manage at any one time. Historically, this has averaged about 18 drugs in the pipeline. However, they have now revised the way their IT systems gather and organize clinical data so their managers can handle 24 or 25 drugs in the pipeline. Since each drug costs about \$350 million to develop and generates billions in revenues, this increase in a core competency represents a tremendous increase in their business potential. It has also allowed them to sell their interest in the joint venture with Dupont for over \$4 billion since one reason for entering that venture was to expand their ability to conduct clinical trials and the FDA approval process across another organization.

Similarly, Nippon Steel is currently enhancing their core competency in managing the production schedule for their steel mills, a very complex task since each order represents a slab of steel with its own unique specifications, such as amount, coating, thickness, composition, etc. Nippon Steel is doing this in conjunction with IBM Fishkill which has developed a new mathematical algorithm. Fishkill believes NSC is one of the

few firms in the world that can introduce the system and use it. The results for NSC could save tens of millions of dollars in process inventory while complementing the e-commerce and data base co-operation with trading and auto companies explained below.

A related finding to enhancing core competencies is that these firms do not reorganize themselves to use available or new software technologies. Indeed, they generally reject concepts of outsourcing or re-engineering, though their cultures are technologically oriented. For example, both Takeda and Merck have elected to use SAP systems, but they have not adopted SAP's entire integrated system. That would require a substantial reorganization. Instead, they purchase and adapted a particular software package that was cost effective and then integrated into their system.

This approach supports our conclusion that leading U.S. and Japanese software users are customizing in similar ways. That is, leading U.S. firms are doing more customization to enhance particular core competencies while the leading Japanese firms are using more packaged software when they can adapt it to their overall system. These firms are gaining increased control over their use and development of information technology. They are also using specific criteria to make their selection between packages and customization. Generally, if a package will do the job and is cheaper, including adaptation and system integration, they will use it. These firms are not wedded to either packages or customization for their own sake, but rather to what works and is cost effective.

In terms of determining what is cost effective, these firms will not sacrifice user functionality or revenue enhancement merely to use a package and reduce costs. For these companies, evaluating software has in turn established beneficial loops where enhanced core competencies and successful strategies have led to better business performance and further software improvements. For example, Meiji Life uses Windows NT as the inter-communication operating system for its new laptop based marketing system for its sales representatives. However, the program incorporates Meiji's proprietary life cycle model and is tied to specific life insurance products, which is totally proprietary and customized. This model has resulted in an increase in the consistency of sales across their 40,000 representatives while reducing paper costs and branch office expenses as the representatives can now communicate directly with the corporate mainframe.

These leading users have clear criteria related to their business strategies for selecting software. However, these do not include using the latest software or IT technologies for their own sake. Rather, business, organizational and software strategies are driven by industry economics and a firm's competitive position. Therefore, when evaluating new integrated business systems such as SAP, they do not buy the whole system but rather purchase pieces they feel can do a specific job more effectively and cheaply than a customized package. As noted by both Nippon Steel and Toyota, a major reason for this decision is that the systems developed by these leading firms involve hundreds of millions of lines of code and are so complex and tightly integrated with their organization that these new enterprise software packages just cannot replicate the benefits and functionality of the these firms' current systems.

This organizational comprehensiveness is reflected in the software strategies of these firms and extended from mainframe through PCs. Furthermore, because software is related to the firm's organization and business strategy, it is not easily emulated by

outside competitors. Thus, a firm can establish a competitive barrier, especially if the software system involves hundreds of millions of lines of code, and mainframes are used for distributed processing since such programs are not easily transferred. All of the firms are quite conscious of this competitive benefit, although Toyota is probably the most articulate since they have seen the problems GM has had in implementing their system.

Naturally, this software often involves mission critical systems that support major databases and key operating systems. Therefore, these systems must work, and the risk of a failure is unacceptable. This drives a rather conservative *risk averse incremental approach* for all the firms with respect to adopting new technology to support core competencies, and is another reason why they reject enterprise system solutions. Toyota and Credit Swiss First Boston (CSFB) both typify this approach. The latter particularly notes that their trading and investment business is generally client, transaction and product specific. In addition to capturing contextual specificity there is confidentiality and fiduciary responsibility which force a *risk averse approach* to developing and adding software. Thus, system changes for these firms are evolutionary not revolutionary.

To insure that this approach is consistently implemented, most of these leading software users have set up evaluation systems to ensure the cost of customization. A new system is really paid for through benefits such as reduced cost, improved inventory management, lower cycle times, better market information, or consistent organizational performance. They track this through cross-functional approval and review committees. NEC and Merck are particular examples of this. NEC has committees of managers and engineers that examine and review the software used in each part of the design and production process. This is critical as the software controlling each machine in the production process is constantly being upgraded and NEC cannot afford to fall behind a competitor in production efficiency. At the same time, they do not want to upgrade if another package is better or if the benefit of an upgrade or change is marginal. They look carefully at cost, functional benefit, and the elapsed time to full efficiency improvement.

Merck has cross-functional committees involving top managers as well as people from manufacturing, R&D, finance, IT, and marketing. These committees then examine each dollar of IT investment using the same return criteria demanded by Merck of a dollar invested in drug development, including the application of their business financing option concept. The latter criteria forces the committee to examine the potential cost of not making or delaying the investment or developing the new system as well as its benefits.

While there are differences between firms, industries and countries as to the critical competitive variables and resulting business strategies and core competencies that use IT, there do not seem to be any systematic differences among these factors. In other words, all Japanese firms do not pursue a particular approach, such as customization, while U.S. firms do. Similarly, while all manufacturing firms are conscious of controlling inventories, so are many service firms. For example, Meiji Life and CSFB try to control document storage and securities held in their trading or commercial paper portfolios. Furthermore, inventory control is not done blindly since, as we have noted in the case of Toyota and NEC, buffer stocks have been increased in order to improve line efficiencies coupled with a decrease in raw material and finished inventories. Rather, the common theme among all the firms examined is using IT to improve core competencies and strategic results with specific outcomes.

Because of this close integration of strategy, organization and IT within these

firms, the CIO (Chief Information Officer) is usually located in senior management and considered a valuable asset to the business. In some cases, they are also responsible for embedded software, which requires combining product and software knowledge to enhance a firm's product. Product data then interlinks with data base management. In this way, software adds value to product and service; not just cost. There is no truly independent MIS department in these firms. For these firms, using IT is subject to the principles of *Kaizen* or continuous improvement

They do this by constantly introducing innovations and new developments incrementally with organizational evolution, all driven by the sharp clarity of their business/industry vision. Software is adapted to business and competitive needs rather than to accommodate a purchased system or just to introduce the latest technology. These firms generally recognize that the packaged solutions available cannot improve a firm's competitive advantage unless it is linked to part of a larger, proprietary system that contains benefit features that act as barriers to entry or enhance performance. The current presidents of Ito-Yokado and Citicorp are probably two of the most prominent examples of this phenomena as both come from a technical part of the business and built their reputations on the application of systems to improve business performance; Mr. Suzuki in 7-11 and John Reed in retail banking.

In addition, these leading software users are employing information technology to control all aspects of their business including parts of their external business environment. This has led us to postulate a new production paradigm called AControlled Production@.

Controlled Production Paradigm

Controlling production (CP) is not just a way to reduce costs but to improve business performance and organizational effectiveness. It differs from mass production which achieved economies through scale using standardized parts, or lean production which reduces costs through more continuous manufacturing processes. CP seeks to improve business by using information technology to control all aspects of product or service delivery, including after sales service, repair and supplier relationships.

One of the most interesting aspects of the AControlled Production@ paradigm is how firms use IT to control and influence their external environment.⁻ This is because such control and influence can potentially redefine the normal microeconomic relationships we assume among firms, their suppliers and their customers. In addition, by capturing and sharing unexploited externalities, these firms can improve their competitiveness and increase their market shares, establishing beneficial loops that can alter current competitive relationships. In turn, these changes may impact both customers and suppliers and, in turn, their customers and suppliers. For this reason, I have provided more detailed explanations on how these leading firms are successfully using Information Technology.

Nippon Steel (NSC): Currently, large Japanese trading companies control Japan's steel

⁻ Currently a consulting firm, Cambridge Technologies, is advising large corporations on this concept in terms of an "extended firm". See Invest with the Masters, Phillips Publishing, November 1998, p. 2

ordering system. These major trading companies receive orders by fax from their customers, such as auto producers, ship builders and large construction firms, for particular types and quantities of steel. The companies then bundle the demand and order the steel by fax from the steel producers. NSC and other Japanese steel makers place the orders with their mills through a complex production allocation system designed to track the process from steel production to shipment to the final billing of the customer. Since each order represents a separate slab of steel with its own dimensions, thickness, weight, coating, purpose, customer, etc., tracking and managing this production process is a complex task lasting as long as three months. Moreover, receiving and monitoring the order for the trading company and its customer is also sophisticated, especially since each trading companies ordering system is different. To facilitate the ordering and allocation of the steel among its different mills, Nippon Steel has developed an e-e-commerce system where the trading companies= orders are received electronically using a consistent and common format. This has reduced errors while permitting both NSC and the trading companies to track the order without requiring time consuming faxes or phone calls. As a result, NSC can now adjust its production schedule to respond to changes and customer priorities with more ease. In this way, NSC has used IT to extend its control over the ordering system. This is a great advantage to NSC and its customers.

Information Technology also supports NSCs auto replacement parts project. The company has been working with trading and auto companies to reduce the finished steel they must keep for auto replacement parts, their single biggest inventory expense. To avoid having to maintain large stock piles of steel replacement parts to meet the increasing demands of automobiles requiring specific types of steel (such as size, thickness and coating), NSC is now working with trading and automobile companies to calculate the actual amount of steel necessary in on-hand inventory. This program is managed by a complex software and data management program that can calculate the actual inventory needs for replacement parts and split the costs between NSC and its customers. Car owners will no longer need to wait three months for replacement parts if they find themselves in an automobile accident. This strategy is one more example that demonstrates how NSC is using IT to extend its influence beyond the firm for the benefit of the company and its customers.

Merck: The most expensive and time-consuming aspect of managing the drug pipeline is clinical trials, especially phase III, which involves human subjects. Merck has undertaken several IT related initiatives that extend its influence outside the firm to improve its efficiency in managing this process. The company now feels it can manage 24 or 25 drugs in the pipeline due to improvements in managing clinical trials. This effort has paid big dividends in potential growth as well as the number of therapeutic areas in which it can work. First, Merck has developed and made a medical term dictionary available to all doctors involved in clinical trials for Merck or anyone else. The company believes that if one can improve the consistency and meaning of terms used by researchers in reporting their observations during clinical trials, Merck will need to spend less time rewriting, checking or interpreting results. It also means the company can better understand the results of trials undertaken by competitors in related drugs. Similarly, Merck is using an open system to influence external behavior patterns affecting the firm by establishing and maintaining a free library on genetic material where people can post and obtain information, thus reducing any one firm or scientists= ability to patent and monopolize a

particular research result.

The medical dictionary also facilitates and contributes to another big IT initiative outside the firm, which is automating the stage III clinical trials in terms of reporting to the FDA and the approval agencies for other countries relative to applications for the approval of new drugs. Merck has been a leader in helping to draft the common automated application guidelines and the way supporting data from the clinical trials should be gathered and reported. Given their resulting familiarity with the guidelines and the ability to use their own experience and competencies to support their views, they have effectively developed an interactive systems-based approach which translates into faster approvals, reduced costs, and more drugs in the pipeline. They have extended this concept to gathering prescription-related data at the pharmacy level, giving Merck the ability to respond more quickly with lower inventories to patients' needs for prescription refills.

One unanticipated benefit of this system has been a reduction in unmonitored switching between similar drugs which pharmacists did automatically when a Merck product was not in stock. Another important benefit of this data collection system is its ability to improve upon earlier warnings of potential side effects in new drugs that only emerge once it has been approved for widespread sale and use. Given the potential liabilities associated with such unexpected side effects, the ability to closely monitor after sales information at the pharmacy level is an important strategic and competitive benefit.

Toyota Executives and business analysts frequently recognize the competitive advantage in having one's own product or system accepted as the industry standard. A firm knows this standard better than its competitors and can introduce changes and modifications so as to favor its products or services. This has certainly been part of Merck's strategy in making its medical term dictionary widely available. Interestingly, Toyota is taking the same approach through its Intelligent Transportation System (ITS). ITS is a sophisticated information technology system installed in automobiles that combines a computer with a navigation system and a computerized highway. One uses ITS by entering a highway and then indicating via the on-board computer where the car should exit. The highway's computer then uses the on-board computer to control the car and drop the passenger at the appropriate exit. While U.S. manufacturers see this development as speculative and several years away from introduction and Toyota's Japanese rivals do not have the resources to support the required R&D effort, Toyota is funding the project in Japan and expects to have a pilot project operating there in about five years. Toyota then plans to have its functioning system adopted as the international standard after going through the international forum on ITS. Since Toyota believes that a single on-board computer will inevitably replace the microprocessors currently running a car's independent functions, such as brakes, fuel injection or suspension, they envision a convergence of ITS, embedded software and the automobile's technological evolution. ITS is influencing this external development which Toyota expects will increase demand for their cars.

Other ways in which Toyota is using information technology to extend their influence beyond the company and capture potentially beneficial externalities include the replacement part requirements for steel noted above. Presently, Toyota is extending this idea to develop a database on repairs that may ultimately be tied to information stored in the on-board computer for each car. This information and the related system are strategically important because repairs related to warranties are a rising expense for many

auto producers. Toyota will increase long-term profits if it can use this data to improve the design or production of its cars while reducing warranty claims or recalls. Toyota can also use this situation to improve its prices and/or its warranties relative to competitors. Finally, like Ito-Yokado, Toyota has given its suppliers more access to its information system so they can improve their production and delivery scheduling. This is an important change in their approach from when they were interviewed in 1994 (Rapp 1995).

Ito-Yokado (IY) - Ito-Yokado is particularly aggressive in tying its suppliers, contract warehouses, and trucking companies to its IT network. This is because they want their business strategy to keep inventories low relative to sales. IY has systematically and increasingly outsourced such functions as warehousing (which uses land) and trucking while making sure suppliers have the data they need to carry or produce just the amount of product IY requires. Thus, they help all these firms to become part of the IY network. By making their suppliers more efficient in their relationship to IY, they lower their own costs.

Meiji Life - Japan is now facing a Big Bang of its own which will allow all financial firms to compete across business segments. This means every financial company is facing a wide range of new competitors. But they will also have the chance to offer new products to existing customers even with no special competitive strength in that product or service. To sell these new products and services, Meiji Life has developed a life cycle profile of their customers and their financial requirements that they demonstrate and deliver through a network of laptops carried by their 40,000 agents.

Their strategy's success depends on both the agent and the customer understanding the model and the information presented with ease. Thus, a key aspect of the system is having the customer develop an appreciation of and interest in their life cycle financial requirements. Success also depends on the role Meiji can play in satisfying those needs through a range of products, which will include those where Meiji has previously not been allowed to compete. At the same time, training and using the new system helps Meiji's salesforce to learn, accept and market these new products and services. Meiji will create competitive barriers to competing firms with a different approach only if they are successful in getting the customer to accept their view of their future requirements and Meiji's ability to meet them on an integrated basis.

As part of their attempt to educate their customers on the benefits of the new environment and Meiji's approach, it has also been necessary to get the customer to adjust to less paper. Meiji has done this by showing their customers the benefit and convenience of more customized policies that are printed directly from their representatives' laptop. Finally, since individual life insurance products account for about 80% of Meiji's profits even though only about half their insurance is in force, the importance of this approach has a clear business basis.

NEC - In the semiconductor industry NEC believes the key to their competitiveness is their ability to respond quickly to changes in demand while keeping production costs low

- For more discussion of Life Cycle Model used by Meiji and Sanwa to market to Japanese retail clients see

A Final Report Symposium on Building the Financial System of the 21st Century: An Agenda for Japan & the United States,? Program on International Financial Systems, Harvard Law School, 1998 p 183-191

and production technology on the cutting edge. This means NEC must control production equipment on a timely basis by introducing changes in the systems used. Since much of this equipment is controlled by software written in English by the companies who produce the machinery, NEC must be able to adopt this software quickly to effectively tie the equipment producers into their production paradigm. Therefore, the company has decided that their semiconductor division will operate totally in English, including their own production information system. In this way, NEC has used software in an innovative way to positively alter their ability to work with suppliers and periodically improve software systems controlling production equipment. In turn, by increasing the integration with their equipment suppliers, NEC has been able to utilize equipment or related software improvements more effectively while being able to influence such developments as well.

Takeda - Like Merck, Takeda has had to develop software systems that can manage and interact with the new international standard application process and more automated phase III clinical trials, in order to sell its drugs globally. Yet global sales are critical to spreading the high cost of developing new ethical drugs over the largest possible market. In addition, to reduce inventories and match production with sales more accurately, Takeda has moved to improve the information flow with Japanese drug wholesalers. The company has done this by pushing the other Japanese pharmaceutical companies and Japan's drug wholesalers to develop an integrated industry-wide inventory and order system in conjunction with SAP. In this way, Takeda has extended its influence beyond its boundaries by organizing an integrative IT initiative to influence sales and after-sales support in Japan,

Citicorp - Citicorp has established itself as the leader in international retail banking. Their leadership status has required the development of support systems on a global basis across a range of services including credit cards and ATMs. Citicorp's desire is to make these services into industry standards. They have started this process by initiating a series of alliances with major providers in various countries that tie these financial service providers into the Citicorp network. Citicorp can also offer their upscale retail customers in other countries easy access to their countries' ATM and credit card networks so they suffer no loss of convenience and service domestically while their global benefits are enhanced.

Nomura - As in many other countries, the securities industry is highly regulated in Japan, with many reporting requirements. Understanding and complying with regulations is critical to a firm's success. Nomura has been able to influence this process by developing and maintaining the standard software for reporting on securities trading. Because its program is accepted by the MOF as the standard, other firms have found it less expensive to buy Nomura's program than to develop and maintain their own. Not only has this enabled Nomura to create the standard, but also to convert a cost into a revenue stream. As reporting requirements and technology change, Nomura is able to benefit from being able to work with the MOF prior to those changes being implemented. Its revenues then increase, as other firms must upgrade to the new system. The Big Bang should only enhance this benefit as more financial firms feel the need to offer securities and related products in addition to other services as part of their comprehensive life cycle package.

Sanwa Bank⁵ - Due to the pressures of the ABig Bang,[@] the decline in corporate lending, and the entrance of all Citibank branches into retail banking, Sanwa has been forced to develop an innovative approach to the retail banking business not only to differentiate themselves from other banks, but also new competitors such

as life insurance and securities companies. Their strategy has emphasized automated branches to deliver an expanding range of services related to their life cycle model of customers' requirements which is analogous to that used by Meiji Life. To differentiate their strategy from competitors, Sanwa depends on three basic elements 1) their retail banking infrastructure, including branches and information network; 2) their retail marketing strategy; and 3) their evaluation of people's lifestyles or pattern of personal development throughout their lives. Although difficult to predict, Sanwa makes a special effort to analyze and manage data related to items two and three. Sanwa envisions their customers as having an evolving and growing set of financial needs that change over the course of their lives. The bank believes that when their customers are young and entering the workforce their need is likely to be for credit cards and consumer related financial products. Upon marriage, they need debt products such as mortgages for an apartment, which expands to a house and life insurance as they have children. Then there are savings for college, weddings and retirement. The question is how to track, market and deliver these products in a timely manner as well as assure their development evolves in a way responsive to changes in lifestyle and technology. Furthermore, how valuable is the typical customer on a discounted basis and how easily can a firm retain them throughout the cycle? What is the appropriate time to start marketing, how much investment should be made per customer and what is the most effective way to both market and deliver special product or service?

To address these and related questions, Sanwa has developed a matrix identifying different customer groups and their banking needs according to lifestyle. They cross match this with a set of products for which they carefully control costs. Their primary target is young people just starting their careers who are the fastest growing retail market segment in Japan with the greatest long-term potential. However, they are expensive to service using traditional branch banking but can be efficiently serviced electronically via automated branches, telephone and the Internet. Sanwa's plan is to appeal to this market segment's greater acceptance of technology by offering them new products tailored to their changing financial needs, including their growing earning power and expanding needs. Sanwa hopes to improve customer contact, reduce customer migration and keep cost low by acquainting their customers with automated banking at an early date and by continuously increasing the number and quality of services offered through their automated branches, which are much cheaper to open and maintain. By targetting and reinforcing the technological bias of this group, they are using information technology to influence the behavior and tie on an interactive basis a growing and increasingly profitable customer segment. But for the strategy to work Sanwa must gather and manage a range of information about this client base so they can offer products in a personal and timely way while constantly improving the efficiency and user appeal of their systems. Interestingly, this approach has avoided the problem of some U.S. banks that have unsuccessfully tried to change existing client behavior to force them to use electronic systems. Rather, Sanwa's view is to match products and delivery systems with the targetted audience. Therefore, Sanwa continues to be truly customer oriented, serving traditional

clients through their branch network.

In sum, Sanwa has studied each segment and knows what products and services it wants. The bank uses IT to monitor them and keep information in service delivery loops so when an event occurs they can solicit related business. This re-enforces customer acceptance of the life cycle approach.

Comparing U.S. and Japanese firms: Information Technology and Organization

All of our leading software users both in the U.S. and Japan face environments where they must justify the use of their products or services to increasingly cost conscious customers in terms of improved performance and benefits. At the same time, they must develop new products and services that are more complex and expensive. Yet, all of the firms recognize the need to develop and market their products so they can grow and prosper. These products, especially manufactured goods, must often be sold on a global basis to amortize high development costs or the cost of continual improvements. To do this efficiently, sophisticated techniques to acquire and manipulate large amounts of data in a standardized manner are required, including development, production, marketing, delivery and after sales service or performance. In the end, using systematically gathered data as well as sophisticated analytical methods successfully in their decision making is critical to their business and future growth.

Even though the need to use information technology in this manner is clear, the leading users believe the purpose of these systems is to improve their firms' existing decision-making skills which is what has been responsible for their success. Therefore, using systems should not result in automatic managerial decisions but should rather improve the quality of the firm's decisions by enhancing a manager's experience and judgment. Thus, even though one important use of software is to facilitate better communication, these firms still use face-to-face communication among managers in formulating strategies and making decisions, including those related to IT.

At the same time, managers do not believe the more information everyone has the better off the firm will be. They consciously try to create some barriers among employees to limit the information flow. Still, using software enlarges and extends an employee's knowledge domain. So, particularly highly qualified representatives should have full access to such information since it is most valuable when those with good judgment understand and use it well.

Nevertheless, these firms believe that the use of information technology to enhance and improve existing core competencies avoids many organizational dilemmas since people can see that their effectiveness and the company's competitiveness is improved without the need for substantial reorganization and accompanying disruption. This strategy contrasts with companies such as Bayer that use a minmax approach to software use and development because this approach focuses on achieving maximum user functionality for the least cost. Under these systems, a firm uses a software package if it achieves 80% of the functionality users request without evaluating whether the additional 20% of

functionality represents a critical added value or is important to maintaining core competency. This approach also stresses centralized IT control to facilitate upgrades rather than to develop strategies and allocate resources. Thus, firms using the minmax strategy do not support certain functions even when the user may require them to efficiently utilize an historical database or certain programs that may only be available for a MAC or VAX system. Furthermore, the minmax strategy is typically supported by a review process with a check list of 20 to 25 benefits that are evaluated for each IT project, making it difficult to isolate one or two key business factors in terms of IT integration or the enhancement of core competencies critical to the business (Track 1997).

The press and various reengineering specialists have stressed a flattened organization as one outcome of improved information systems because it is easier for top management to communicate with lower levels, and middle management is no longer required to process information or manage and set objectives for smaller units. Being able to eliminate middle managers saves money and is cost efficient. But the leading users examined in this study did not generally note these benefits and when they did mention them they felt that any effect from the increased use of information technology had been indirect, i.e. they have flattened their organization first to prepare for future competition and make each person's responsibilities more clear. They had to become slimmer because their competitors did.

From the perspective of these firms, the role of information technology has been to assist each person to be more productive in their defined responsibilities. Easier monitoring of subordinates via improved information systems has not been a reason for moving to a flatter organization. This result is similar to other responses from these companies that indicated that the role of information technology has been to enhance and extend existing strategies and core competencies rather than to restructure or change the organization. At the same time, through an innovative mix of customized, semi-customized and packaged software, these firms have created information systems and organizational supports for those systems which have significantly improved their competitiveness in several areas. An important aspect of this development has been the interactive linking of various functions that previously were relatively separate within the organization such as R&D, manufacturing, marketing, sales and after-sales service.

One important common organizational aspect of the best practice firms is the integration of IT into their organizational structures through the extensive use of cross functional groups and committees to both organize and monitor IT activities. In this manner marketing, production, etc. are all involved in assessing and managing different software projects giving them a better appreciation of the interlinks between the firm's different functions and the role of IT in assisting this process as well as in enhancing various business capabilities. This has facilitated the implementation of IT strategies and the firm's ability to capture beneficial feedback at different points in their overall business, demonstrating the competitive power of a controlled production. These results are consistent with Professor Harker's study of call centers which suggest that a proper balance between human organization and the IT system is critical to success because customers impose limits on the system's complexity and the employees' ability to understand and

manage it.- Thus, AIT spending alone does not correlate well with improved performance. ... the key is >smart design= and paying attention to process impact.@

APPENDIX

Company Questions re Strategy & Operations

General Management and Corporate Strategy

Yes

No

PRIVATE __Has the firm integrated software into their management strategy, including using it to institutionalize organizational strengths and capture tacit knowledge on an iterative basis?

Has the firm succeeded solely on the basis of its software strategy?

Does the firm believe some customized software and its close organizational integration enables the company to capture and perpetuate on a more consistent basis certain tacit knowledge and unique corporate features, i.e. core competencies, that account for its continued success in the marketplace with reliability and repetition important elements in their thinking?

Is the firm's software strategy successful because it is a well managed company that introduces software innovation when it serves corporate goals for enhancing productivity, inventory management or customer relations within its industry?

Does the firm generally meet established criteria as a quality organization such as: effective organizational self assessment, use of project and especially cross functional teams, improving quality outcomes through reducing uncertainty, rapidly diffusing learning throughout the organization including the use of software and information technology, effective implementation of organizational and technical change, facilitating change via evolution rather than revolution or reengineering⁻, emphasizing participatory management, having process excellence, using value added analysis, actively doing benchmarking, constant organizational improvement, commitment to concrete realistic goals, effectively managing a dynamic iterative experimental process through goal setting, training and constant consultation?

Does the firm plan in detail for world class operational excellence including the contribution of software and information technology to the allocation of resources?

Do their planning systems enable management to make better business, operating and resource allocation decisions, including those related to software and IT, with a link to resource valuation techniques?

⁻ MIT Systems Dynamics Group in a September 1997 presentation estimated that 70% of reengineering efforts fail.

Do they focus on a small number of priorities, usually three or fewer, with a well defined, cascaded system reaching from the commitment of senior management to the department level with associated metrics?

Is the firm a high performance workplace for services?

Is there a heavy emphasis on improving process through using software?

Industry Related

Are industry economics and competitive dynamics an important strategic driver for the firm and for its use of software and information technology in that IT has been adapted to the firm's particular industry and competitive situation?

Do industry paradoxes exist such as: declining stock prices, manufacturing improvements that create product improvement difficulties, or employees' active product use that retards improvements?

Competition

Is software a significant and successful input into the firm's competitive performance?

Does the firm explicitly and consciously perceive the implications of their software strategies and use on their competitiveness and business success?

Are there direct links between their software strategies and overall management goals?

Do customers, affiliates, competitors, industry analysts, government officials, industry associations and suppliers perceive the competitive benefits or impact of the firm's use of information technology?

Has the firm gained first mover advantages through successfully introducing software related innovations?

Country Related

In pharmaceuticals does nationality seem to be a causal factor in determining the impact of software on the firm's competitiveness?

IT Strategy

Is firm a sophisticated software user that consciously designs and implements a software strategy to achieve competitive advantage?

Does the firm utilize several types of software input alone or in combination to achieve competitive advantage?

Does the firm's system work to rapidly uncover barriers to implementation, including using new or improved software, while generating cross-functional and hierarchical consensus so measured goals can be achieved?

Is leadership at different levels actively involved in driving software planning, assessment

and deployment with regular progress reviews that link plans, goals, benchmarks, metrics, milestones, resources and responsibilities?

Does the system allow for flexibility and innovation as well as change and individual efforts provided they meet goal, planning and metric criteria?

Is there a clear vision making project and new product software selection straightforward and closely related to strategic goals and processes?

Does this software strategy involve a conscious and clearly defined reliance on customized and semi-customized software in addition to packaged software with specific criteria and goals for selecting each type, and do they have ways to measure this so that the firm knows customized software achieves functional or market gains that justify the additional expense, including related costs of integrating customized and non-customized software into a single information system?

Does the firm use option valuation methods to manage uncertain and random outcomes since this appears to be at the software implementation frontiers even among very well managed companies?–

Does their strategy include increased use, development and integration of industry and company specific vertical application software and embedded software in its production and delivery processes to improve competitiveness?

If the firm has an embedded software strategy, is this integrated or interactive with their other software and overall business strategy in ways affecting production, product design or service that improve quality and costs long term?

Do they favor increased outsourcing of software design and development?

Does the firm believe large-scale outsourcing by many U.S. companies assumes those firms= information systems development need not be integrated with their business organization and that they view their information systems as generic products best developed by outside vendors who can achieve low cost through economies of scale?

Do they feel these firms= approach focuses on the cost side of software and that these firms do not see differences among the systems used by their competitors?

Do they in turn believe this is a mistake by their competitors that gives them a long-term and sustainable competitive advantage over such companies because they believe outsourcing surrenders a firm=s strategic software options since systems service companies have an incentive to develop increasingly standardized products and are one step removed from the company=s customers and business?

Has the firm established a software strategy that is open and interactive with its customers and/or suppliers?

Has this enabled it to capture information or cost competitive externalities?

IT Operations

– Easton, George S and Sherry L. Jarrell, “Using Strategic Quality Planning More Effectively: Lessons Learned from NSF Project Research,” Columbia Business School conference presentation, September 1997

Do participants own goals and are then committed to implementation strategies?

Does the firm embed software into its production and delivery processes with competitive market implications?

Is software technology tied to high speed telecommunications technology, allowing the firm to track, receive and deliver shipments or services directly or on-line without further handling or processing?

Does it manage the potential risks of extensive use of software or open systems?

Do they work to ensure consistency and reduce programming errors?

Is informal interaction a key aspect of planning and implementation?

Is the firm's system institutionalized and self-reinforcing with good communication and consensus building while software and IT play a role, including preventing retrospective justification or target reduction?

Human Resource and Organizational Issues

Does the firm pay close attention to systems training and organizational integration for all employees, reducing errors through improved consistency and staffing efficiencies across the firm since software can confound even routine operations?

Does certain software require special HR competencies or education?

Does the firm try to change human behavior to use software?

Parameter Metrics such as Inventory, Cycle Times and Cost Reduction

Are goals or targets tightly linked to regularly reviewed metrics with inputs coming from all levels that are often cross-functional affecting large parts of the organization, e.g. cycle times, on-time delivery, and customer satisfaction?

Does the firm have standard agreed ways to explicitly organize or manage this software selection process?

Does the firm have agreed ways to measure and evaluate success in using software to promote business objectives such as unit cost, inventories, lower receivables, market share, model development times, or product pipeline?

Are IT costs balanced against overall long-term productivity gains?

Does the firm have methods to ensure increased customization costs result in lower costs downstream so that developing and using customized software makes sense?

Has the firm created large interactive databases to allow automatic feedback between stages or players in the production and delivery process? And are these databases constantly being refined and updated on an interactive basis with actual performance results in a real time global environment? What are the competitive and metric impacts of this? such as reducing inventory costs and wastage while improving the quality of customer service?

Has the firm used software to create beneficial feedback cycles that increase productivity,

reduce cycle times and defects, and integrate production and delivery processes?

Do other firms or analysts have alternative measures competitiveness or views on appropriate industry strategy?

Has the firm achieved better than industry growth, superior on-time delivery, improved inventory control, reduced down-time or changeover cycles, reduced product or process defects, fewer recalls, lower warranty claims, an improved product development process, and/or any other definite and measurable progress relative to competitors?

Do the firm=s metrics go beyond financial to areas like customer satisfaction, operational performance, and human resources?

Does their evaluation system apply to new product development and significant projects as well as to continuous operations?

Summary Case Questions relative to Conclusions

PRIVATE Conclusions and Results

Can you summarize a mission statement on the role and impact of software as a tool of competitive advantage for these firms in this industry?

Is it consistent with the strategies identified as successful or appropriate in the existing competitiveness research from Sloan=s industry study center?

Are there important business or IT situations that require further research?

Are there differences in the successful use of software by firms in traditional industries and newer high growth industries or between manufacturing and services? For example, do differences exist in competitive conditions between mature industries and services and high growth markets or as between manufacturing and services that lead to different software strategies?

Are intellectual property issues important in explaining the successful and sustainable use of software to achieve competitive advantage?

Are beneficial cost impacts generally one important consequence of a successful software strategy?

Is there a company profile where software seems most likely to contribute to enhanced competitiveness?

Based on these studies is the market for vertical application and embedded software growing?

Since Japanese competitors normally do not outsource, do Japanese firms see themselves as benefiting from this U.S. trend?

Do leading U.S. and Japanese firms assign positive value to improved integration and enhanced control through selective customization?

Do general measures such as increased productivity, as evidenced by reduced cycle times

and lower defect rates, reflect the benefits of a successful software strategy?

Are the benefits of a successful software strategy also reflected in specific industry standards such as an expanded customer base, an increased number of drugs in the pipeline, or improved yields?

Do leading IT users have explicit criteria for selecting package versus customized software and for semi-customizing software packages?

Do these firms closely integrate or couple their software and business strategies beyond mere alignment?

Do they closely integrate their organizational and HR policies with their software systems?

Do such firms reorganize in order to successfully use software and information technology?

Do these firms= software codify or build on existing organizational strengths or core competencies including HR alignment with business and IT strategies?

Do these firms embrace and integrate information technology as part of their business strategies and core competencies?

Are MIS departments integrated with the rest of the firm in terms of organization and decision making?_

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industries being examined include food retailing (Ito-Yokado and H. Butts), semiconductors (NEC and AMD), pharmaceuticals (Takeda and Merck), retail banking (Sanwa and Citibank), investment banking (Nomura and Credit Suisse First Boston), life insurance (Meiji and USAA), autos (Toyota), steel (mini-mills (Tokyo Steel and Nucor) and integrated mills (Nippon Steel)), and apparel retailing (IMart). The case writers and the research team wish to express their appreciation to the Alfred P. Sloan Foundation for making this work possible and to the Sloan industry centers for their valuable assistance.